

Learning Activity 2

To start the activity, students will have a whole class discussion about base ten blocks and how this can be used to represent decimals. After students decide what decimal will be represented by each piece (using the 1000s cube as one whole), students will use the base ten blocks to answer questions about adding and subtracting decimals. Instead of using the actual manipulatives, students will use the National Library of Virtual Manipulatives site (http://nlvm.usu.edu/en/nav/frames_asid_264_g_2_t_1.html?from=category_g_2_t_1.html) on the laptops. First, students will answer five problems created by the computer and record the answers on their lab sheets. Next, students will create five problems given to them on their lab sheets and find the solutions. While doing this, students will look for patterns and connections to fraction addition/subtraction. Finally, they will create algorithms for adding and subtracting decimals.

The lesson will start out as whole class discussion using actual base ten blocks. The teacher will facilitate this discussion. Then, students will work individually with the simulation in the classroom. The teacher will move around the room at first helping students to troubleshoot the technology. Then, the teacher should help deepen the students thinking about connections and patterns by asking questions: “What fraction would be represented by each number? Using the rules of fraction addition, how might this help you find your answer? When you borrow in the subtraction problem, how is that represented in the base ten blocks? What strategies did you use find the correct answer?” Then students will work in pairs or groups of three to find patterns, connections, and algorithms. The teacher will ask similar questions from the individual work to help guide students towards their own strategies. Finally, we will have a whole class summary of algorithms created. The teacher will facilitate this discussion by asking students to share strategies and helping students to the similarities in each strategy.

In order to participate in this lesson, students will need to know how to turn on and log on to the laptops. They must also know how troubleshoot when a laptop is not working (i.e. wireless is not turned on). There must a link to the website on our class wiki or the URL should be shortened (i.e. bit.ly or tinyurl) so students can have easy access to the site. Students should also know that Internet Explorer, not Firefox, should be used to visit the website. Students will also need a quick demonstration of how the simulation works and where to find the instructions if they do not know what to do once they get started.

Learning objective

For my 6th grade students, the learning objectives for this lesson are to fluently add and subtract decimals and to look for patterns in problems in order to create an algorithm. By the time the activity is complete, students should be able to add and subtract any two decimals and be able to explain why the answer is correct.

Technology Integration

Using the virtual manipulatives helps to enhance the learning by allowing students to see the connections between the algorithm and place value. For example, when a student exchanges ten single cubes for one rod, the simulation shows the carrying of the number from the thousandths to the hundredths in the number sentence. The simulation reinforces the notation of place value when adding/subtracting decimals by showing why a number is changed in the next place when exchanging blocks. The simulation also enhances the lesson by helping the students to move more quickly through problems. When I have used base ten blocks in the past for a lesson like this, students will play with the blocks, creating towers and pictures. Students will also waste a lot of time getting the problem set up and doing the exchanging of blocks. The simulation either sets the blocks up for the student or can allow the student to set the blocks up themselves in a shorter amount of time. Students can't "play" with the blocks during the simulation. Also,

exchanging blocks is much easier because students simply need to draw a rectangle around a group to exchange it. The simulation does a nice job of modeling how to set up a decimal addition/subtraction problem by adding on the zeros automatically to make each number have the same place value. It is important that this point is brought up in the class discussion and algorithms so students know to do this when finding a solution. Lastly, the simulation enriches the lesson because it begins to introduce students to the idea that a subtraction problem is the same as adding the opposite of a number. The subtraction model on the site uses red blocks, which usually represent negative numbers. To subtract, students actually create zero pairs. Negative integers are represented when the normal manipulatives are used. By using red blocks and creating zero pairs, students are creating prior knowledge of integers that can be brought into our study of integers later in the year and in 7th grade.

The teacher in this lesson will be a facilitator. Instead of the traditional method (introduce the algorithm, show some examples, let students practice), the teacher never actually shares how to solve the problems. The students use inquiry to find out how to solve the decimal problems and the teacher facilitates the process by asking questions. The teacher can also become a technology support person or can ask students to help troubleshoot throughout the lesson. Instead of the teacher helping to focus students who are “playing” with the blocks, the teacher can now focus on help students to gain access to the math in the lesson.

To support the students with the technology, the teacher will make sure the simulation is modeled for the students once before beginning. The teacher will also make sure the instructions are pointed out to the students. Lastly, the teacher will monitor the students and troubleshoot technical issues as they arise.

Connection to Standards

This lesson will focus on the Common Core State Standard of fluently adding and subtracting multi-digit decimals using the standard algorithm for each operation. Two technology standards will be

addressed in this lesson. First, students will demonstrate creative thinking and construct knowledge through the use of simulations. Knowledge about adding and subtracting decimals will be constructed when using the virtual manipulative simulation. Second, students will use critical thinking skills to solve problems using appropriate digital tools. Students will collect and identify data about decimal addition and subtraction in order to make informed decisions when solving similar problems.

Student Prior Knowledge

To access prior knowledge, I will open the lesson by asking students where they have used base ten blocks before. What number did each block represent? I will ask for students to share examples of how to use the base ten blocks to add and subtract using regrouping. I will also ask students to share what addition means and what subtraction means. I will ask students for examples of the different ways to represent addition and subtraction. Students will also be asked to share how place value works differently for decimals than whole numbers.

In order to make sure students have the necessary prior knowledge, I will be allowing the students to use a tool we created for the decimal unit. This tool is laminated half sheet of paper. The sheet shows the place value for numbers before and after the decimal point. It also has spaces above each place value so students can enter the digit of a number that belongs there. During the launch of the activity, students will use a vis-à-vis marker to write on their tool what block represents each place value. For example, under the tenths spot, students will write the word “flat” to show that the flat block represents one tenth. I will also demonstrate how a student can enter a decimal onto the tool and use that to make sure the correct blocks are being used to represent the number.

Content Knowledge

In order to be successful in this lesson, a teacher must have a strong foundation in place value and how it relates to decimal operations. A teacher must understand how the base ten number system works. For example, a teacher must know that ten hundredths is equal to one tenth. In addition, a teacher must understand why the standard algorithm has students adding and subtracting numbers in the same place value. A teacher must understand how to use regrouping in addition and subtraction. The definitions of addition and subtraction are also important: addition as combining and subtraction as taking away, zero pairs, or missing addend. Teachers must be aware of the connection between fraction addition and decimal addition. For example, when you make common denominators for fraction addition, we are actually adding the same place value together in decimals. Teachers must understand equivalent decimals, such as 0.1 is equal to 0.100.

Teachers must also know the most common misconception is that students will line the numbers up to the right of the problem instead of lining the decimals underneath each other to find the answer. The second most common misconception is when students are subtracting a decimal from a whole number students will forget to add zeros to the whole number and just drop down the decimal values (i.e. $1 - 0.25 = 1.25$ instead of 0.75).

Pedagogical Knowledge

In this activity, I chose to have students work independently on the computer, work in pairs, and then have a whole class discussion because my students learn best working in varied settings. By working independently on the computer simulation, students are given the opportunity to explore the math concept individually. Because the simulation has instructions, it can be scaffolded for students who are struggling. Scaffolding can also occur by allowing for more practice and will tell a student when the correct answer is reached. Students can be successful on the activity with very little assistance from the teacher. The computer simulation also allows for differentiation for the higher level students making it an ideal

independent activity. Students can change from base 10 to base 5, creating an extra challenge for the students who need to be enriched.

Partner work and class discussions for the algorithms section is appropriate because by working together, students deepen their understanding of the concepts. Partner work requires that students share their thinking with each other and requires metacognition, deepening the level of understanding of the math concept. With a classroom discussion, the students can learn from listening to each other but can also learn from each other's mistakes. In our classroom, we celebrate mistakes and learn from them. By having a class discussion these misconceptions can be uncovered and cleared up by the students.

I choose to have the students look for connections between fraction addition/subtraction because again the understanding of the math will deepen. When students can make connections to previous concepts, the new concept can make more sense and students are more likely to remember the concept.

Technology Knowledge

The technology used in this lesson requires that the teacher is not only comfortable with a laptop but also understands how wireless internet works and how the simulation functions. A teacher must know how to turn on a laptop, navigate to Internet Explorer, create and find a link on a wiki or create a shortened URL, and how to turn the laptop off. A teacher must also know how the laptop shows a wireless internet connection and how to troubleshoot if the connection is lost. A teacher must understand how to troubleshoot network login problems, if a district has a network. A teacher must also know how and when to call a district helpdesk, if available.

The teacher must also know how to manipulate the website to fit the needs of the students. The students should use Internet Explorer since Firefox can have issues accessing the Java required to run the simulation. Knowledge on how to update Java, if need, is also crucial. Configuring the simulation so students can match the class introduction of what each number is represented by each piece in the base ten

block set is an important piece of knowledge for the activity. For example, in my classroom, the students would want the decimal place to be equal to 3 so that the flat represents 0.1, a rod represents 0.01 and a single cube represents 0.001. The teacher must also know how to access the directions on the simulation and where the lesson notes are for teachers.

TPACK Analysis

Adding and subtracting decimals, at first, seems simple to students because of experiences with money and therefore can give them a false sense of understanding. In the past, I have found that students have little issues with adding/subtracting numbers with the same place value but when two different place values are in a problem, more students seem to get the incorrect answer. For this reason, I feel that this math concept demands a deeper understanding of the place value and why decimals need to be aligned. The pedagogical strategies chosen in this lesson help students to access the deeper understanding of place value.

I chose to use the base ten block simulation in conjunction with partner work/class discussion of algorithms for several reasons. In the past, I have simply introduced the algorithm to the students, showed examples, and then gave students problems to practice. Most students could perform the algorithm that day in class but when asked to do homework that night, there were always many questions. Most students could not tell me why the algorithm worked or show multiple representations of the problem. When I introduced the base ten blocks, students began to understand the connection between the algorithm and place value. They began to understand why the algorithm worked. In addition, many of my students are visual or kinesthetic learners so having manipulatives available for them matched their learning styles. The base ten blocks also gave another representation of the solution besides numerical.

Whenever I have given students algorithms for any problems in the past, about two thirds of them forget the algorithm or forget parts of it. I have had much more success when students create their own algorithms for two reasons. One is that students can recreate the algorithm if forgotten the next day, a week

later, or a month later since it was created by them in the first place. In addition, it takes a deeper level of understanding of the math concept in order to create an algorithm. Second, I like to give the different algorithms titles, for example Shawn's method. The students enjoy this and feel a real ownership of their learning because other students will state how they are using "Shawn's method" to solve the problem.

In our class, we usually follow the pair thinking/class share method when creating algorithms because of a couple reasons. A pair thinking/creating activity allows students to question each others' methods and look for examples that will fit the algorithm and ones that will not fit the algorithm. This strategy allows for students to talk with other and build confidence so that when we share as a class, there tends to be more class participation because their ideas have been validated by their partners. A class share of algorithms is important because we can look for similarities between the algorithms which leads to a better understanding of the math.

Laptops were a logical choice for my classroom. Our school has twelve laptop carts available so as long as I plan far enough ahead, I can easily have two available for class work. In addition, when we work in the classroom, it is an easier transition from individual computer work to partner work/class discussion than it would be in a computer lab located somewhere else in the school.

I choose to use the simulation because of my experiences with base ten blocks in the past. Base ten blocks can be very powerful when teaching place value to any grade level. The physical experience of "seeing" a number and regrouping into the next place value is what many students need to grasp a better understanding. Some teachers feel they belong in the lower grades but I have found because students have prior experiences with the blocks in the lower grades, it is easier for students to understand different numerical representations for them. There are some disadvantages to using the actual base ten blocks. First, students are easily distracted by the blocks. I often have to focus students who are creating buildings instead of doing the math. Second, the blocks can make quite a mess and I constantly find them all over the floor. We always have to devote a good amount of time to cleaning up at the end of a lesson. Between the

playing and cleaning up, a significant amount of learning time is lost. I choose the simulation because it can cut down on this non instructional time. Students cannot create buildings in the simulation and we only have to shut the computers down and put them away at the end of the lesson, which my students are becoming more efficient at the more we use the laptops in class. I also chose the simulation because it clearly shows the connection between exchanging the blocks and the math work done on paper (the carrying of the digit to the next place value or the borrowing of a digit for subtraction). In the past, some students have struggled to make this connection. This particular simulation also allows for the students to do some guided practice and create their own problems. Not all base ten simulations allow for this. Also, we can customize the settings so that students can work up to the thousandths place value and practice the Common Core standard of working with multi digit decimals.

Assessment Plan

There will be several assessments throughout this activity and afterwards, both formative and summative. First, as students are working on the simulation, I will monitor the classroom and assess student work on the simulation. Next, I will assess student learning but circulating through the partners and listening to their thinking about the algorithms. I will also assess the learning but assigning homework problems that night that require students to use an algorithm created in class. My last formative assessment will be a short quiz either the next day or the following day covering adding and subtracting decimals. I will use all of these assessments to determine who needs more practice on the concept. My summative assessment will occur on the unit test, in which there will be several questions asking students to solve computation and story problems involving decimal addition and subtraction.

I will know my learning objective is met if students can do two things independently. First, students should be able to answer decimal addition and subtraction with 85% accuracy. Second, students should be

able to explain why their answers are correct with either a model or words. If students can do these two tasks, then the learning objective was met.